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# B.M.S. College of Engineering, Bengaluru-560019

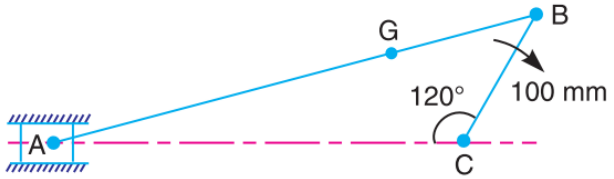
**Autonomous Institute Affiliated to VTU**

## September / October 2024 Supplementary Examinations

**Programme: B.E.** **Semester: IV**
**Branch: Mechanical Engineering** **Duration: 3 hrs.**
**Course Code: 19ME4DCKOM** **Max Marks: 100**
**Course: Kinematics of Machines**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|
| 1 | a) | Explain the various types of kinematic pairs. Provide examples for each type. | CO1 | PO1 | **06** |
| | b) | Define Kutzbach's criterion for determining the degree of freedom in a plane mechanism. | CO1 | PO1 | **06** |
| | c) | In what way Oldham's coupling is useful in connecting two shafts when the distance between their axes is small | CO1 | PO1 | **08** |
| | | **OR** | | | |
| 2 | a) | With the mathematical proof, describe the complete working of a Peaucellier mechanism. | CO1 | PO1 | **06** |
| | b) | Explain in detail with a neat figure, the mechanism used in shaper machines which helps in minimizing the cutting time by increasing the speed of the idle stroke of the shaping-tool. | CO1 | PO1 | **07** |
| | c) | Which mechanism is being used in stone crushing machine and with a neat sketch explains the construction and working of the same? | CO1 | PO1 | **07** |
| | | UNIT - II | | | |
| 3 | | An engine mechanism is shown in Fig.1. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s$^2$. Find:<br>(i) velocity of G and angular velocity of AB, and<br>(ii) acceleration of G and angular acceleration of AB.<br>  <br>Fig. 1 | CO1 | PO2 | **20** |
| | | **OR** | | | |
| 4 | a) | Derive the expression of coriolis component of acceleration. | CO1 | PO1 | **06** |

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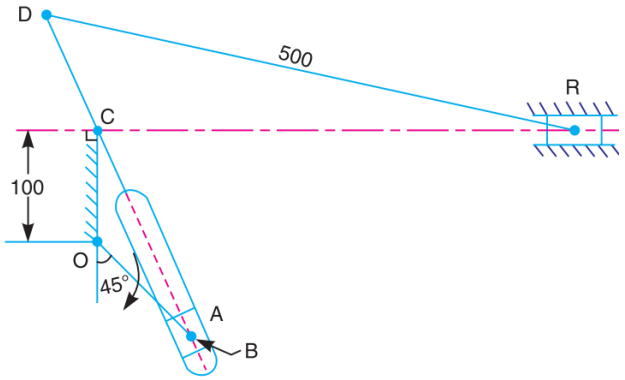
|---|---|---|---|---|---|---|
| | | b) | In a Whitworth quick return motion, as shown in Fig. 2. OA is a crank rotating at 30 rpm. in a clockwise direction. The dimensions of various links are: OA = 150 mm; OC = 100 mm; CD = 125 mm; and DR = 500 mm. Determine the angular velocity of BC, the acceleration of the sliding block R and the angular acceleration of the slotted lever CA.<br>  <br><br>All dimensions in mm.<br>Fig. 2 | *CO1* | *PO2* | **14** |
| | 5 | a) | With a neat sketch, describe the procedure for determining the velocities of links in a slider crank chain mechanism by using Klein's construction method. | *CO1* | *PO1* | **10** |
| | | b) | Two $20^0$ involute spur gears mesh externally and give the velocity ratio of 3. The module is 3mm and addendum is equal to 1.1 module. If the pinion rotates at 120rpm, determine:<br>(i) the minimum number of teeth on each wheel to avoid interference<br>(ii) contact ratio | *CO2* | *PO2* | **10** |
| | | | **UNIT - IV** | | | |
| | 6 | a) | Compare simple and compound gear trains in terms of their design. | *CO3* | *PO1* | **04** |
| | | b) | In an epicyclic gear train, the internal wheels A & B and compound wheels C & D rotate independently about axis O. The wheels E & F rotate on pins fixed to the arm G. E gears with A & C and F gears with B & D. All the wheels have the same module and the numbers of teeth are $T_C$ =28; $T_D$ =26; $T_E$ =$T_F$ =18.<br>i). Sketch the arrangement;<br>ii). Find the number of teeth on A and B;<br>iii). If the arm G makes 100r.p.m. clockwise and A is fixed, find the speed of B. | *CO3* | *PO2* | **16** |
| | | | **UNIT - V** | | | |
| | 7 | | Design the cam profile for the following conditions:<br>Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for $60^0$ cam rotation; dwell for $45^0$ cam rotation; return stroke with SHM, for $90^0$ cam rotation; dwell for the remaining period. Determine maximum velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction. | *CO4* | *PO2* | **20** |

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